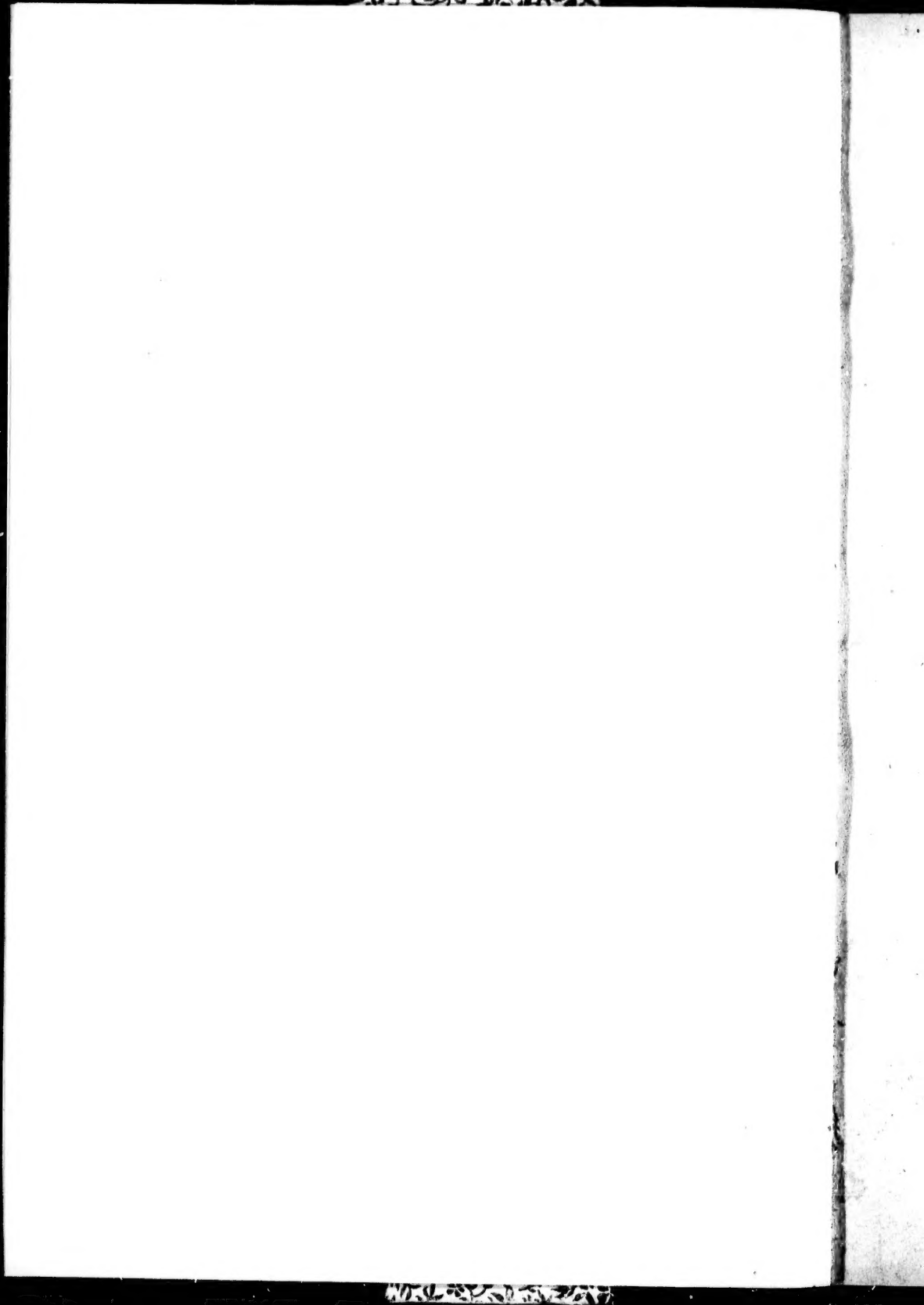




REPORT
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UPON THE
PRELIMINARY SURVEYS,
FOR THE
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TORONTO:

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REPORT.



To the President and Directors of the London and Gore Rail Road :

In executing the important trust reposed in me, as your chief Engineer, I consider myself fortunate in the selection of persons employed to aid me. My principal assistant, in the labors of exploration, has been Mr. Tracy McCracken. Supplied with all the needful instruments and a select party of assistants and labourers, Mr. McCracken has prosecuted the preliminary surveys, with great industry and perseverance. He has traversed the line of country from Hamilton to Chatham, running double lines, some portion of the distance, examining with much care difficult points of the route, and taking partial views of the country from Hamilton to Queenston, and from Chatham to Sandwich. These services have been impeded by a partial outfit, by unfavorable weather, by all the obstructions of a wilderness most of the way, and, along the valley of the Thames, by the necessity of moving their baggage and provisions down the river in a boat, while their line of operations lay from two to six miles distant. Their work commenced the twenty-seventh day of July, and their field work closed the first day of November.

I regret, that my engagements were such when accepting your appointment, that I could not appropriate more time to the acquisition of a minute knowledge of adjoining sections of the country, from Lake Erie to Huron, and enjoy opportunities of a personal acquaintance with most of the Directors, Stock-holders and gentlemen familiar with localities, on different portions of the line. But having, within a few years visited several parts of the Province, and during the survey of this year, examined the difficult points in the route, and with particular care the valley of the Thames, and the table lands bordering the same, I venture to hope, that I shall be able to meet your views, in the present enquiry.

The advantages of internal improvement, by roads and canals, have never yet been sufficiently appreciated. They were dimly seen, by the

most powerful nations of antiquity, by whom some mighty labors, of this description, were effected. But in these cases, the purposes of war, personal renown, and the consolidation of power, were the motives of action; and the general prosperity only incidentally involved. Yet they were among the most operative causes of national greatness. In modern states these advantages have been more clearly discerned, and more assiduously cultivated. Of all the arts by which industry is stimulated, and wealth created, none are found so diffusive as those which facilitate internal communication, between different sections of the same people. And those nations now most illustrious for their power, and most distinguished by their opulence, have most extensively conformed their policy to this truth.

The enterprize in which you have engaged is exceedingly important, promising, if faithfully and completely executed, the most expansive and beneficial results. It is emphatically the great measure, by which the populating resources and safety of the Province may be most amply promoted. Stretching through the centre of a tract of fertile country several hundred miles in extent, nearly surrounded by navigable lakes, and intersected by several streams now in part opened to the use of Steam Boats, such a road as you contemplate, would, almost at once convert to the best uses of humanity, an immense, but hitherto secluded accumulation of the bounties of nature. Such results cannot be anticipated without a glow of generous emotion. Whoever contributes to their creation, by his labors, his counsels, his capital, or his influence, will deserve the praise of a public benefactor.

A work of such extent, through a country so new, cannot be conducted with the greatest economy, and so as to defy miscarriage, without much and constant attention to detail. To furnish details of facts and principles, and plans of operation, in application to your intended improvement, is the immediate purpose of this report. To this purpose, permit me now to solicit your attention.

That portion of the Province south of the 44th degree of north latitude, is made a Peninsula, by the waters of the great Lakes; it is wholly of secondary formation; and embraces the most valuable region of British possessions, in America, for Agriculture and the richness of its forests. Near the northern limits of this region, runs an immense range of calcareous rock, being an extension of the terrace, of that formation which constitutes the southern boundary of the basin of Lake Ontario, and which, crossing the Niagara river, sustains the level of the upper lakes. Over this Terrace passes the drainage of a large tract of coun-

try lying west and north of it. It is from four to five hundred feet in height; and in places, where sand and clay are deposited on its crown, forms a dividing ridge to the water courses.

In a central position, between lake Erie and Huron, is formed an elevated table of country diversified in its surface by gentle undulations, and forming the highest land, in this portion of the Province—being from seven to eight hundred feet above Lake Ontario.

From this table emanate Grand River, the Thames, the Credit, Kettle Creek, and several streams making into lake Huron. In the aggregate the source of these streams running in every direction, occupy about one third of the country lying south of the terrace, and east of London.

The belt of land surrounding this elevation, and extending to the Lakes, on three sides, and to the terrace on the fourth, is of peculiar character. It differs materially from other portions of the Province, and the neighboring lands of the United States.

This belt consists principally of clay for its base, having, in its higher portions, sand and gravel lying in horizontal tables of different elevations, above the Lakes. All these tables are broken by deep ravines forming the beds of water courses, some of the largest of which, by their serpentine directions, have worn for themselves, in many places, wide vallies. Into these vallies numerous smaller rivulets, coming from a distance in higher table lands, have by their currents, extensively undermined and broken down the outline of the vallies receiving them.

Considerable portions of table lands, in positions nearly central, between the principal rivers and the Lakes, are covered by swamps, which collect the drainage of these tables until it swells above the lower points in their external boundary, where it is precipitated in the form of rivulets, with high and abrupt banks.

The higher lands contain scattering boulders of primitive rock, and the earth is of a character to withstand much more firmly the wear of the streams.

Traces of gypsum exist, in the bed of Grand River, and lime is a component part of the soil, over the whole Peninsula. In this brief description of the country, the observing cultivator will see proof of its great agricultural capabilities, and whoever explores it will need no further evidence of the value of its inexhaustible forests of oak and pine, and other esteemed varieties of timber.

The strongly marked topographical features of the Peninsula are :

1st, a moderate elevation of table land between the great Limestone

Terrace and Lake Erie, bounded east, by the straits of Niagara, and west, by higher lands composed of clay and sand, which give rise to the Welland River, and Twenty-Mile-Creek, and several smaller streams discharging into the Grand River, and heading near the Mohawk or Brantford Road.

2dly, a higher table south and west from Grand River, above which it rises one hundred feet; but descends westerly, in approaching Lake St. Clair and Detroit River, so as, in their vicinity, to form but a slight elevation above them.

This region is separated into two parts, by Kettle Creek, which heads in the Oxford high lands. Both parts of it exhibits surfaces irregular and broken, at the mouths of their water courses.

3dly, a narrow belt of land, between the Thames and Great Bear Creek, extending from the north branch of the former westerly to Lake St. Clair. This region presents a more level surface, and is much less broken, in consequence of the diminished length of the tributary streams.

4th, a section, between Bear Creek and Lake Huron, embracing Little Bear Creek, and extending to a point east of the River Sable.

This region from the character of its streams, and information derived from others, in respect to a part of it, differs not much from those already described. Further north and east we have not penetrated. It is known however as a valuable portion of the Province and principally owned by the Canada Land Company—and has prominent interest as connected with your enterprize.

In new countries, the settlements commence at commanding points, on the navigable waters. Here cities arise, and commerce locates her numerous agents. From these points enterprizing men survey the inland districts. And where they find a combination of fertility, in the soil, and easy communication with places, which can supply their wants, and purchase their surplus products, they form interior settlements. If heavy falls of water offer their service, and the forest and the mine proffer their treasure to the use of man, at these localities, they soon become large manufacturing towns, and while they reward the industry of those immediately engaged in their labors, they constitute new markets, and central points, from which other settlements extend, in a continually enlarging circle.

This is the present condition of the Province. And it is so interesting and attractive as to call out, from the mother country, men of active disposition, of capital, and of science, to engage in the beneficent

work of uniting the interests of all the settlements, and giving a new and general impulse to the means of Provincial prosperity.

Unfortunately many individuals, who contribute largely to the welfare of particular districts, imbibe such strong local attachments, and accustom themselves so exclusively to the view of local results, that they are apt to oppose schemes of improvement of much larger application, and the number of such individuals increases with every increase of the places of profitable business. Hence the great importance of adopting early a general plan of internal policy, which shall, in just measure and time, reach and enrich every portion of the Province. The first great feature of such a plan will be brought out, in constructing the Rail Road provided for by your charter. In this work, therefore, the laborer, the farmer, the manufacturer, the merchant, the men of science and of capital, may all unite their exertions with perfect assurance of contributing to a common and most valuable object.

The value of artificial channels of intercourse depends upon the amount of tonnage passing through them. This amount must depend in a great measure upon the adjacent soil, and its products. Grazing countries supply a much less amount than grain countries. Good wheat lands, in actual cultivation, offer annually about three fourths of a ton per acre for transportation.

The whole tract traversed by your Road being of this description, wheat or flour, will constitute a main article entrusted to the care of the forwarder. Timber is extensively used, in every growing settlement. It constitutes a large portion of the material of all sorts of buildings, where its abundance makes it cheap, and a good road or canal makes it of easy acquisition. And besides the great demand of it for these local purposes, good timber will pay the expense of transportation many hundred miles, where facilities of carriage make its exportation easy, rapid, and safe. The opening of your Road, and its connexion at both extremities, with navigable waters will give to the forests, which border it, these facilities. Not only the rising villages and cities of the Province, but the commerce and navigations of the great waters which the Author of nature has spread before you, will put forth a constantly growing demands for this article.

From the great thoroughfare of your road communications, more or less easy, will soon be opened to every favourable point of settlement, on both sides. And reaching the locations of limestone, building stone, gypsum, and other heavy articles, an active interchange of these for salt, iron, and every kind of merchandize, will necessarily arise.

The capacity of transportation on a rail road, has its limits, and once opened for use, the one which your enterprise embraces, will give such a spring to every kind of improvement, and so augment the population, and articles of transport connected with it, that its capacity will be filled; and it will eventually be used only for the conveyance of light goods and passengers.

In the commencement of this work, an important consideration relates to the extent of territory to be accommodated by its use. In my view it may be safe to anticipate, that one third of the Peninsula will resort to it for all their ordinary export and import, and a still larger portion for personal passage. The country being naturally capable of sustaining a great population and supplying the highest average amount of outward and inward tonage may be estimated at four thousand two hundred and seventy-five tons for every six miles square.

The Lake navigation so well understood by the inspection of the maps; and the extent of country, which it accommodates, so open to the personal observation of many whom I address, need no comment from me.

All are aware of the great obstruction presented by the straits of Niagara, and of the incalculable benefits of obviating, in some adequate way, the stubborn barrier which interposes between the upper lakes and their natural markets, in the cities below. To surmount this barrier was the object of the Welland Canal, a laudable enterprise originally undertaken by individuals, and extensively aided by Government, but not yet perfectly accomplished. It is to be much regretted, that the artificial portions of this valuable improvement, had not been constructed upon a plan more solid and durable. Most of them founded upon earth of the most unfavorable character, the temporary locks appear to require already very extensive reparation, if not a complete reconstruction. Experience has shown that upon such a basis no lock or other heavy and extensive artificial structure, for a Canal can be rendered durable, without much care in laying the foundation and then raising its massy walls with suitable stone prepared, cemented, and secured according to the most approved methods of masonry.

This work however benefits a great territory bordering the line of your proposed improvement. The slack water navigation of Grand River, by its connection with this canal and lake Erie, will be a useful outlet for the productions of the interior, and the import of all such heavy articles as the wants of its neighboring settlements may indicate, and will afford profitable returns to its stockholders.

At the head of the improvements in Grand River passes the line of your Road, as we have surveyed it, and it will interest you to learn, that by the Rail Road to Burlington Bay, the distance will be only twenty-three miles forty-six chains; while, by the River and Welland Canal, to lake Ontario it will be about eighty miles, obstructed by 400 feet of lockage; and that a passage between these places, in the former direction, will be effected in one hour, while, in the other, it will require about thirty-six hours.

Individuals interested, however, should view this subject with great liberality. In proportion as the mind is accustomed to trace the intimate connexion of interests which subsists between all the parts of a society united under the same government, the great variety of channels which serve to circulate the prosperity of each to, and through the rest; in that proportion will it be little apt to be disturbed by solitudes and apprehensions, which originate in local discriminations. It is a truth as important as it is agreeable, and one to which it is not easy to imagine exceptions, that every thing tending to establish substantial and permanent order, in the affairs of a country, increase the total mass of industry and opulence, is ultimately beneficial to every part of it. On the credit of this great truth, all the friends of improvement in the Province may safely acquiesce in, and promote the enterprize you propose to effectuate.—all the existing channels of intercoruse will soon be fully occupied in supplying the wants of the country, and the stock-holders in them amply rewarded for their investments, and the influence of each upon the rest, will be useful and not prejudicial.

The Rail Road contemplated in this Report will create new and large demands for importation and exportation, through the slack-water navigation of the River, and the more artificial rout of the Canal, and in this way more than repay what it may take from them.

The Thames, as well as Bear Creek, presents a limited inland navigation for Steam Boats. That of the Thames extends as far as Chatham, and constitutes a useful outlet for a rich and important district of country. The enquiry may be made, what other artificial improvements may be projected for the benefit of the country; and how far they may effect the enterprize we are endeavoring to illustrate. It is understood, that a project is entertained of connecting Grand River with the Thames by a canal and of providing a slack water navigation, on the latter, in connection therewith; and that surveys and plans have been entered upon to forward these objects. The Thames is very crooked (being 95 miles from London to Chatham the lower 30 miles favourable, the other 65

miles nearly double the distance as compared with the line of Rail Road, by which the whole distance from London to Chatham, is 64½ miles,) and flows between banks of extremely crumbling earth. Its shores exhibit evidences not to be mistaken of frequent changes, in its channel. A slack water navigation would afford but an imperfect and very circuitous conveyance, if it were effected. The use of it in descending would be annoyed by the sudden and numerous turns, in the current, and after all would take most articles of country productions further from the markets. It would always be slow, laborious, and expensive. The necessary dams and locks would be constructed, on the worst of all foundations, and not without a proportionate cost; and when made in the best possible manner, would be very insecure. The freshets in the Spring, or a high flood at any season, could hardly fail to damage them essentially; sometimes undermining them, and at others by forming a new channel, leaving them entirely out of the stream. It would be long before the annual repairs would not exceed any probable amount of receipts.

That portion of this project, which seeks a connexion between these two rivers by a canal, would accommodate a populous and enterprising district, at Woodstock and its vicinity: it should extend to London, and would be feasible if sufficient water could be secured, at the summit level between the rivers. Whether it may or not, should be most carefully examined, previously to the removal of a single spadeful of earth in the execution of the canal.

Lands covered with a dense forest depositing its falling leaves, and other ruins annually on the surface, retain much more water at the top than the same lands do when cleared and cultivated. The vegetable matter constituting the top soil absorbs and holds water like a sponge; and at the same time obstructs the excess of rains and melted snows from speedily draining off. The case is very different when the top soil is nearly exhausted by repeated cropping, and the health and comfort of a spreading population, have made it necessary to clear out the springs and rivulets in every direction, to aid the escape of the surplus waters. So great is this difference, that a country deemed too wet, for the purposes of agriculture, in its wild state is often found too dry, when thoroughly opened to the sun, and subjected to the plough.

If it was contemplated to intersect the Peninsula by canals in a central location the subject should be examined with enlarged views; the sources of the Grand River and Thames sought for feeders, and the line of canal follow the table lands remote from the tributary streams entering the vallies by deep ravines.

The opening of the canal in question connecting, say, London with the Grand River slack-water navigation, or one of much greater extent and importance, would in the opinion of your engineer, be favorable to the great Rail Road you have in prospect, and the Rail Road certainly would be of vast use in the constructing of the Canal. On this work, the locks to be durable must be well founded, and of the best masonry, and the lime stone, water cement, and iron for all of them, and for the other works requiring these materials, on the whole line, must probably be brought, the former from Ancaster, and the latter from Hamilton, on the rail road.

In advancing the great interests of Internal Improvements in the Province, the prudence of a Paternal government looking to the common good, would incline especially to foster those schemes, which prepare new facilities for communication, between important points remote from each other in the territory, *by direct passages through the interior*. The benefit of such schemes will ensure much more exclusively to the people of the Province, and at the same time, be much less subject to injurious contingencies than any others. The expenditure and exertions necessary in the accomplishment will call out a greater proportion of Provincial industry, and be more likely to unfold Provincial resources.

In time of peace, a new country situated far inland, and depending more for its ultimate prosperity, upon agriculture, its home manufactories and domestic interchanges, than upon all other sources; while it should faithfully perform all its obligations, and cherish all its exterior interests; should be chiefly careful of spreading industry over its best lands, opening to the fertile interior proper channels of commerce, and calling into profitable use, its forests, its minerals, and waterfalls. The policy increases in the greatest degree that wealth which is most vital to the just purposes of government, and gives to it the greatest security.

In war facilities of transportation on the border of a country, are liable, at many points, to be interrupted by hostile incursions when they are most wanted; and the chances of war may open them more to the use of a powerful conterminous enemy, than to that of the government which promotes them. And the wealth immediately connected with such facilities, is always greatly exposed.

The effects of establishing the most perfect means of transportation through a country, upon the value of property in it, is greater than any man without much observation and reflection, will be disposed to admit. Where the policy of such means is extensively and judiciously applied, men witness, from year to year a wonderful growth of all the social in-

terests. Towns, villages and cities, for manufacturing and commercial objects are seen spreading along their path as if by enchantment. The rude features of an unfrequented wilderness, with its variety of ferocious tenants, rapidly give place to all the charms of a diversified and profitable cultivation and for thickening throngs of active, useful, and intelligent families of human beings. The great art of internal improvement leads in all the other arts, that enrich and embellish our earthly existence; and the dignity of science and the blessings of piety crown the whole, with their unfading lustre.

It is the decree of the most high, that all the wealth he has created, or rendered possible, is to be valued only *for its use*. Things inaccessible cannot be used. The richest land upon which the sun ever shone, would be altogether valueless, if surrounded with an impassible barrier. Remove the barrier, introduce the laboring hand, the contriving mind and the will to create and diffuse the means of subsistence and improvement, and the land will soon yield up all its treasures for the enjoyment of man. The most perfect methods of removing barriers to all the inland wealth of the world, hitherto devised, consist in rail roads and navigable canals. And these great inventions not only remove the barriers of this wealth and excite multitudes of the requisite labors for drawing it out and storing it up for human use, but they invite to permanent location, and productive exertion, along the lines they traverse, swarms of the most enterprising and effective individuals engaged in the other needful occupations of life; thus bringing the most profitable of the markets, to the door of the cultivator and giving to all employments and trades abundant and certain subsistence. This explains the mystery of the great rise in the value of land and other property—produced by works of these kinds. If land, labor and capital compose all wealth, this indicates how they are made to effect each other most beneficially, and shew forth their highest powers of production.

In calling your attention to the London and Gore Rail Road, and to the path of my professional duties, I propose to divide the line into five principal divisions, as follows.

The first division will extend from Burlington Bay, at the village of Hamilton, in a westerly direction along the slope of the great terrace, ten miles and six chains, to a dividing ridge between the basin of Lake Ontario and the valley of Grand River. The elevation of this ridge is 575 feet above the lake. It is nearly broken through at this point of intersection, being not more than one-fourth of a mile across and composed of sand laying with a steep declivity to the east. Its western declivity

is broken by ravines formed by the land drainage into the Welland and Grand River. At one point, this ridge is reduced by a narrow defile and depression of 40 feet. Here we propose to pass the rail road on an excavation of thirty-three feet and twenty-seven one hundredths, giving us at the place of passage, an elevation above our starting point of five hundred and one feet and seventy-three one hundredths. This height may be attained by a uniform grade, of forty-nine feet and eighty one hundredths per mile, subject to more than ordinary expense of grade in passing one mile on the edge of a perpendicular rock terrace, and passing two principal ravines. It will require extra cutting at, and near the summit.

The second division extends from the ridge to Grand River, a distance of thirteen miles and 40 chains, to the bridge at Brantford. Grand River is here four hundred and ten feet above the waters of Burlington Bay, and we design to cross it thirty feet above the stream. This will give the road a descent in this division, of sixty-one feet and seventy-three one hundredths, averaging four feet, and fifty seven one hundredths per mile. It is proposed to lay this portion of the road straight, from the east end to a point opposite the Mohawk village and from there nearly straight to Brantford. This division is intersected by Fairchilds' creek, running in a deep ravine and by several smaller creeks, requiring embankments or bridges. It abounds with Pine and Oak timber, and has a clay soil, with occasional deposits of sand above the clay.

The third division stretches from Grand River to the summit, dividing its waters from those of the east branch of the Thames. This summit is seven hundred and twenty-six feet above the waters of the Bay. And the length of the division is twenty-one miles, and thirty-five chains.—In this division our line rises two hundred and sixty-five feet, allowing for an excavation of twenty-one feet, at the summit; and would require an average rise of twelve feet and thirty-six one hundredths per mile.

The only obstruction to the economical grading of this division occurs in passing Grand River valley, and reaching the Burford plains, which are one hundred and eighteen feet above the river crossing, and will require a rise of thirty feet per mile, in a direct line. The residue of the ascent to be overcome, will require a grade nearly uniform of eight feet and forty hundredths per mile, Eighteen miles may be a straight line. This division is composed of sand and clay containing Oak and Pine timber, with some beech and maple, near the summit.

The fourth division connects the summit, which lies in the town of Oxford with London, being thirty-two miles and fifty chains in length,

and requiring a descending grade. King street in London is five hundred and forty-nine feet above Lake Ontario, which deducted from the height of the summit, seven hundred and five feet, leaves the whole descent one hundred and fifty-six feet, averaging four feet and seventy-eight one hundredths per mile. The line on this division is mostly straight, with a few easy curvatures. This portion of the road must cross the east branch of the Thames, and several minor streams, where bridges and embankments will be required. They will all be situated in places favorable to their construction. The timber here is chiefly pine, some beech and maple and white cedar. The line passes near Woodstock, Ingersolville, Beachville and through an old farming district in the vicinity of those places.

The fifth division extends from London to Chatham, sixty-four miles and forty-two chains. At Chatham, the land of the village is twenty feet above the water of the river and three hundred and thirty-one feet above Lake Ontario. This division descends two hundred and eighteen feet, which gives, in the average three feet and thirty eight one hundredths per mile. A level grade will be continued the first eleven miles, from London, which deducted, will give an average grade of three feet and ninety-three one hundredths per mile; and will in no place exceed a maximum grade of seven feet.

From London the first ten miles, in leaving the bounds of the valley some curvature occurs, the residue of the distance, a straight line may be selected. This division presents a surface remarkably favourable. The east branch of the Thames requires to be crossed at London. On this division the timber is oak, beech, maple, whitewood, and black walnut rising out of a clay soil.

The whole length of road is one hundred and forty-two miles and thirteen chains.

Whole ascent westward, first and third division seven hundred and sixty-six feet and seventy-three one hundredths. Eastward second fourth and fifth division, four hundred and thirty-five feet and seventy-three one hundredths.

In reference to the resolution of your Board requiring an examination of the country from Chatham to Sandwich; also from Hamilton to Queenston, being parallel lines with steam navigation, I would respectfully state that such examinations have been made, and the subject of your enquiry connected therewith duly considered, and the result is and I am happy in stating, that either of these divisions present very favourable features. I have designated that portion from Chat-

ham to Sandwich as the sixth division in the tabular estimate herewith connected, and that portion from Hamilton to Queenston as the seventh division.

The country from Chatham along the Thames, Lake St. Clair, and the Detroit River, rises to a slight elevation above those waters, and is intersected by extensive marshes on a lower level. A line from Chatham may be traced in one continued direction to intersect the Detroit River at any point; or it may follow the border of the Rivers and Lake without departing materially from a direct line. No grading will be required other than to inclose the timber work, and no stream will be passed requiring any expense other than to leave a passage of the flood waters.

The seventh division on the inspection of the map presents the route from Hamilton to Queenston. This may be passed in nearly a direct line which approaches the lake shore for several miles in the vicinity of the Twenty-Mile-Creek. From a point east of Port Dalhousie to Queenston, between the Ridge Road and the lake the country descends gradually to the shore of the lake where the bank is low. From Hamilton eastward, the surface is of the same character, leaving about nine miles in extent along the shore that is obstructed by a high table of land jutting down from the mountain, and forming banks from forty to fifty feet above the water. This table of land is broken through by deep ravines near the Twelve and Twenty mile creeks and other smaller streams. The several difficulties existing on the great highway passing a little in the interior, for the location of a Rail Road do not show themselves near the Lake shore where the several indentations occasioned by streams may be easily passed by bridges twenty feet above their waters. Reference is had to the tabular estimate for further particulars and to the general remarks upon important connections of great public thoroughfares.

Rail Roads are constructed in various forms, both in England and the United States many experiments and much science and ingenuity have been applied to this subject, as well as to all the machinery to be employed upon them. The relative value of all the forms adopted, is well understood by professional men. You enjoy the advantages derived from their experience, and may therefore more safely proceed in your great enterprize. It is the part of practical wisdom, in every undertaking, to adopt its exertions to circumstances. In a new country where the settlements are divided from each other by extensive wood lands—where stone is to be found in but one location—where

capital is scarce and the rate of interest high—and where the earth, on which the works must rest, is slippery and soft with few exceptions, prudence dictates the adoption of different methods from those which may be most suitable under different conditions.

Having retired for fifteen years from the professions of a Civil Engineer, (in consequence of extensive engagements in active enterprise in Western New York,) I am principally induced to resume the profession, from the excitement incident to the introduction of rail roads, which is an item in the many important improvements of the age, and which has very much engrossed my thoughts for several years. I have compared all the forms of constructing them, which have come to my knowledge. After diligent enquiry, with much solicitude, in reference to the cardinal points of economy in their construction, durability and efficiency, and as your Engineer, I take leave to recommend one, which I have adopted, and believe most applicable to your views. It is of the following description.

1st. Blocks of round timber, from 18 to 24 inches in diameter, sawed with parallel ends, at right angles with their length, are placed in an upright position, with one end resting firmly on solid earth, from which all roots and top soil are carefully removed. Of these blocks there are two lines, 5 feet apart, from centre to centre across the road. These blocks will vary in length according to the surface of the ground compared with the grade level.

2d. Timber 9 feet long, one foot in diameter, spotted on the under side where they are to rest on the blocks, and cut down six inches deep, in a notch 15 inches wide, above the blocks where they are to receive the string-pieces. These are to be placed across the road from block to block, each end extending outside of the blocks upwards of one foot.

3d. String-pieces from 18 to 14 inches in diameter, and either twenty or thirty feet in length. These must be squared at each end, one foot square and at each intermediate ten feet where they are to rest upon the cross timbers above the blocks, and parallel with each other, in two lines lengthwise, of the road. They must be well hewed on the upper side and firmly keyed into the cross timbers.

4th, Scantling 3 by 4 inches, square, placed on their broadest side must be extended along the top of both lines of string pieces, parallel with each other.

5th, Above the scantling, in exact parallelism, are to be placed two ranges of iron bars five or six eights in thickness and two and a quarter inches wide ; and then, the iron bars, and the scantling are firmly

secured to the string pieces, by spikes 7 inches long driven through them both and into the string pieces.

After the road is located, and the grade line established, the timber work is completed, on all parts of it requiring embankment and not subject to a cutting of more than two feet in depth. A kind of working car is then used of simple construction, with four, six or eight wheels, having either of them four boxes, so contrived, as to discharge half their contents between the two lines of string pieces, and half without them, and carrying a cubic yard of earth to each wheel, and thus the embankment is made. Where the cutting is deeper, these cars advance one or two hundred feet, on temporary ways, being moved by horse power, and as the excavation proceeds the permanent timbers are all duly placed and secured, and the road completed. The timber work is all covered by earth within the grade to the surface of the iron except room for the flange of the wheel. Any kind of timber may be used for the blocks and cross timbers; the string-pieces should be made of the best timber afforded by the line of the road, or the adjacent forest.

The earth for embankments, and in excavations, stone and lime for culverts, sawed scantling, iron, &c. are all moved on the line by cars. Forests, defiles, marshes, and inaccessible points, where teams could not penetrate, are accommodated.

Men of much experience in constructing public works, particularly rail roads, have sought with much anxiety for some better means of applying the necessary labor, than that afforded by placing it all under contract. This means has always made it difficult to secure fidelity in the work, and lead to innumerable controversies and delays, in the progress of contracts, and in their final settlement. A method of proceeding in the construction of the Tonawanda Rail Road, has been adopted which avoids those evils almost wholly. An active practical superintendant, with a party of 12 or 15 hands takes charge of the timber work, upon a given section of the road. This superintendant hires and discharges his hands at pleasure. He subsists, pays and directs their labor, keeps a weekly work list, and is responsible for the industry, fidelity and economy of the whole, where the cuttings occur, a car of suitable dimensions for the particular work, with a horse, is placed upon the timber work, under a superintendant and similar regulations. All these parties act in the spirit of an animated competition with each other, and each is proud of having made good progress during the week, as per estimate of his work, by the resident Engineer.

In the first organization of the company, the Directors appoint an Engineer, Commissioner, and Executive committee. The Commissioner is chiefly responsible for the construction of the work in all its parts.

The office of your Commissioner is one of exceeding interest in reference to your success. On his talents, industry, personal vigilance, and example, the activity, economy and progress of every department of action, will very much depend. To much knowledge of the Province, he should add the benefits of experience in the details of this or similar work, the machinery, and the plan of applying labor actually adopted, and should think it no hardship to exert his energies, most of the time, in person, and on foot, to advance the various labors on the line, and secure fidelity in all.

In the building of the road—the more artificial structures—and all the scientific details he is directed by the Engineer. He receives the money to be disbursed from the Treasurer, and accounts monthly to the Executive committee for its faithful application.

With the aid of the Engineer he selects the superintendents, and once a week on Friday or Saturday inspects their work lists, examines into their progress and leaves the amount earned to be paid to all the hands, at the weeks end. On Monday or Tuesday, of each week, the Commissioner calls upon the Superintendant for his work list and vouchers, ascertain whether the hands have been duly paid, and prepares himself for his monthly settlements. Upon this plan, fidelity, industry and economy in all departments of action have been well secured. A similar system is adopted in the economy of traction in the building the road as exists after completed. The iron and freight car-wheels, should be ordered, and on hand at the commencement of the work: and the first month of operating upon the plan above mentioned, will bring into actual and perfect use, several divisions of a Rail Road. These divisions are usually those in which there is no deep cutting, in a month or two more, where the cuttings between them are removed, these divisions may be connected by the completion of the road at the points of their separation, and thus in a short time a considerable length of line may be prepared to gratify curiosity or accommodate the business of those who are interested, and what is more important needful supplies may be taken out, and easy connexion kept up with the more remote working parties. With proper exertions, the first season may witness the application of horse power or steam, to the carriage of passengers and property along a considerable extent of the

road, thus early securing more or less returns of interest on the capital expended.

In all concerns requiring vast amounts of labor, the more simple the plan upon which it is applied, and the more direct and strict the responsibility of all persons employed in it, the better it is for the stockholders. The plan above detailed secures these advantages, while it avoids the evils of large collections of men some of whom may be prone to turbulence, and makes it easy to preserve order and harmony. The superintendants feel the importance of the confidence reposed in them, and are ambitious to exercise their best discretion to ensure a creditable economy. The provision by which the payments are made through the Commissioner, to the Superintendants, and through them to the hands, secures a control to these agents, of the utmost importance to the judicious conduct of the work, without which their responsibility would be comparatively nugatory, and the ultimate expense would be considerably augmented.

The ordinary mode of constructing wooden roads, is to lay two parallel ranges of sills or string-pieces, lengthwise of the road, six inches by six inches square, or four inches by six or eight square, or plank two or three inches by nine or twelve inches, sawed timber, with cross pieces laid at right angles with those placed, from three to five feet apart, eight feet long, and five or six inches by eight inches square. The rails on which the iron rests, being six inches square or five by seven inches, and the iron consisting of bars five-eighths by three-fourth inches wide. All this structure is placed on the surface of the grade, and filled in with earth between the ranges of sills so as partially to cover the cross pieces, for a horse path. On some roads the wooden rail has been secured by chairs or castings, to stone blocks placed in deep beds of rubble or pounded stone.

The more expensive and substantial roads of stone and iron are of various forms. The Edge Rail resting in choirs on stone blocks of various patterns is used in some cases; and in others the T Rail resting on cross timbers bedded even with the surface of the grade, and placed three feet apart, with splicing chains: and in other cases still, the T Rail resting upon stone blocks; or in place of cross timbers, split stone seven feet long, about one foot square, resting on a bed of stone eighteen inches in depth, the whole width of the track. The expense of constructing these several forms of road, varies from fifteen to fifty thousand dollars per mile.

The expense of some of these forms of rail roads, constitutes a fatal

objection to their adoption in the Province, and under present circumstances, ought not to be incurred, if capital were ever so abundant.

1st. Experience has shown that the sawed timber roads are objectionable, when applied to such soils as belong to your rout, because the timber work has not a sufficient bearing surface to resist the action of rains, which settle them into the grade; and they cannot sustain the pressure of locomotives with heavy trains.

2nd. The timber work is placed in the most exposed situation possible, and the form of preparing the cross timbers subjects them to the most rapid decay.

3rd. The timber is too light, yielding under the weight of the engine. This yielding and the settling together of the joints formed by the cross timbers in horizontal sections of the road offer an obstruction to the passage of the wheels equal to a slight ascending grade.

4th. In our climate the winter frosts produce great injury on all such timber roads. The cross timbers being covered with earth, when this earth freezes, (which is the most exposed part of the surface) are raised from the sills, and thus a derangement begins, which spreads and becomes considerable every year, especially in winters of great severity.

As these evils disclosed themselves to my observation, it became a great object to contrive the means of avoiding them, and introducing improvements combining durability, strength and economy. These are requisites of especial importance in new districts; and difficult of attainment in soils rich and deep, and liable to hard frosts. They result in an eminent degree, from the method of construction which I have recommended. That method finds most of the materials on the spot in the heavy forests which encumbers the soil, and which may be brought into and constitute a principal part of the structure, at an expense scarcely greater than would be incurred in removing it out of the way. This very valuable feature of my plan, adapts it most happily to your road, where upon the old methods, the timber could not be sawed and delivered without exorbitant cost; and where there is timber standing within the limits to be cleared, sufficient to answer all the demands for that article. Using large timber in its roughest form, saves the great labour of scoring and hewing it, gives unyielding firmness to the frame work in the grade, and provides ample strength for the transit of any amount of tonnage. The size of the timber and covering it, (except the top of the scantling) with earth secures its soundness for a great length of time. My examinations of timber in similar situations convinces me, that in close

or clayey soils that it will endure from thirty to fifty years, except the scantling, which is but little expensive and may be easily replaced when it decays. Placing the timber work so entirely under the grade, secures it effectually, against the frost, as has been fully tested by a severe winter, on fourteen miles of the Tonawanda Rail Road. The blocks on which the upper timber works rests, are a substitute for stone blocks. They are so covered as to be durable, and so situated as to increase the strength and steadiness of the cross and longitudinal timbers amply shoring up the superstructure in any description of soils, and under any pressure from above, which secures the road for use, while embankments are acquiring solidity.

The scantling and iron plate incorporated with the large and strong pieces by strong spikes, throughout their entire length, have a bearing which will not permit them to settle at all from the grade line before or under the wheels of the Engine, thus leaving the locomotive its utmost power of traction, and compared with stone and iron roads has that medium of elasticity most favorable to the durability of the Engine and cars. Experience has shown, that the great difficulty of keeping in exact adjustment the several parts composing a stone and iron road, creates a serious tax annually, in the destruction and wear of its machinery.

This plan of construction materially reduces the time and expenses of the Engineer department. The line is first located by transit centres, or tangent lines, and benches placed by the test level. This prepares the way for the timber work. This being completed, the Resident Engineer gives the levels upon the cross timbers, and transfers the points of curvature from the tangents, preserving the monuments on the straight lines, and directing the several grading parties to form their slopes, as they proceed with the excavations and embankments.

It avoids the tedious detail of staking out the work for the contractor or superintendent, replacing from time, the stakes lost by the cutting, grubbing, embankments, &c. and requiring all to be surveyed and staked anew when the timber or stone work in the ordinary mode is ready to be placed upon the grade.

The expense of a Rail Road is made up of many different items of labour and materials combined, in many different ways and comprising foreign and local or domestic supplies: it necessarily involves a multiplicity of details. Whatever simplifies these and increases the actual responsibility of those having charge of them, contributes essentially to economy. Practical men know that this can scarcely be too much insisted upon.

In the ordinary mode of constructing Rail Roads too much time is lost, from the inexperience of Directors, in determining upon local interests. The first year is occupied in preliminary and final surveys. Then commences the work of grading, occupying another year and requiring the following winter and spring to give time for embankments to settle. A third season is demanded for putting down the timber or stone work. From defects in various parts of the work, particularly in embankments, and their connection with the more mechanical parts, the next year embraces large disbursements, for repairs. The salaries of agents, the pay of labourers, the interest on capital expended, and the cost of repair for so long a time, before the road begins to be productive, operates unfavorably upon the stock, discourages individuals from embarking a second time in such enterprises, and produces the worst effects upon the whole policy of internal improvement. Any method which requires going over the line of construction, several different times for the completion of it, leads to unnecessary expense; and ought to be rejected as needless. The plan herein proposed, avoids such needless expense, and besides its economy, in the items already referred to, saves nine-tenths of the horse power, indispensable in other processes, with all the inconvenience and cost of forage and accommodations, and always extremely burdensome in woodey districts.

Under the circumstances connected with your road through the wilderness, it would be expedient in my view, after passing Grand River, to employ parties sufficient to occupy five miles of the road in advance. Let their labours be so directed as to finish portions of the line each week, using locomotives for supplies from the beginning. At those points where great obstructions are to be removed a different policy must be adopted. But most of the distance wanting only the timber work, and so much earth to cover it up to the grade level, as will be supplied from the necessary ditch, on each side, the plan above alluded to seems most appropriate.

Great plans of internal improvement often originate with individuals having in connexion with them, private interests to consult, and the limited communities of towns and villages are sometimes so far influenced by such interests as to be for or against them, though of the highest promise, as they shall be made to pass some particular street of the village, or section of the town. Liberal minds should be actuated by higher views.

Every body knows, that it is impossible to construct rail roads and

canals, in defiance of all obstacles. When an Engineer is employed for the location of such works, he must take the country as nature has formed it, and make out his route, and all the great works necessary to the completion of the project undertaken, with the utmost care to avoid every obstacle in his power; and where they cannot be avoided he must form plans to overcome them, with the least practicable effort. His science and his experience are valuable only for these purposes, and if they are to be disregarded, ignorance, stupidity and caprice, would be as good qualifications for an Engineer, as intelligence, vigilance and good judgment. In providing for artificial intercourse of these kinds, it is true economy not to limit charters too narrowly and never to permit private interest to dictate a location. Otherwise the best schemes will prove impracticable, and the stockholders be ruined if any can be found unwise enough to become such: Many Rail Roads are undertaken with more expectations of business without their extremities, than from the country through which they run. In such cases it would be obvious loss to stockholders to depart at all from the shortest and cheapest routes. Extensively as your road must ever be wanted for the conveyance of tonnage and passengers crowding upon it from its immediate vicinity it may be doubted, whether it will not ultimately draw still more profit from the prodigious extent of navigation connected with both its terminations.

Local interest, pressing upon the line of passage should remember, that if it displaces it from the position where the aggregate interests of the concern would have it, an opening is always offered for a rival enterprise; and the consequence may be, that after vast expense is encountered, and the resources of the country begin to take the desired direction, a new project may be executed and grow rich upon its spoils.— The wisest policy for important districts situated off from the most economical route is to connect themselves with it by branches. This will promote the rightful claims without trenching upon the claims of others, and generally more beneficial to a town or village, from the fact, that it commands the trade of the surrounding country. Roads conducted by a well regulated train, at a speed of 20 to 30 miles per hour do not have the effect to divert settlements from natural locations.

The stock of a rail road should be taken for its anticipated profit and the holders of it should constantly direct themselves with a liberal but wise reference to profit. If public aid is wanted to make sure of the completion of a great work, there can be no appropriation more beneficial to the subject, or more honorable to government, than those which sup-

ply such aid. Plans of improvement, which demand more capital than private associations can conveniently supply, and which will affect advantageously the great interests of agriculture, trade, and manufactories, are every way worthy of governmental patronage; and it may be extended to them indirectly to the sufficient encouragement of capitalists or directly with such checks and reservations as will be satisfactory to individuals making investments and partially help forward the work.

A public work may not be able to pay a high interest on the amount expended in making it, or to redeem its stock speedily; and yet be the subject of a wise and prudent Governmental favor. It may be the *sine qua non*, of sending population and improvement through a large interior, of bringing into active and beneficial use, extensive resources otherwise sequestered and inaccessible,—of supplying to commerce and the arts important materials, of giving rise to a great variety of just subjects of revenue,—of enhancing the value of the national domain, and of affording the most needful facilities and securities, in time of war. Surely these are among the highest objects of a paternal policy. They embrace a wide range of the most legitimate duties of government. So extensively do some public works affect the business, property and intercourse of a country, that if they were permitted to be constructed owned and directed by chartered companies or private associations, they might very injuriously encroach upon the powers of government, and essentially thwart its true policy, without any infringement of the laws. By monopolizing transportation, by heavy tolls, and interested exclusions, they would diminish the advantages of competition to the people, and enfeeble the sinews of war to the Rulers. Such works should manifestly be so far owned by the government, as to enable it to enforce the proper restraints upon individual and corporate cupidity. And this it can in no way so well do, without resorting to high handed authority, as by supplying the capital required for constructing the work.

In advancing capital to a Rail Road, stretching through an interior and central section of the Province, rich in its lands and forests, connecting, by the shortest line of extension, navigable waters at its extremities, and susceptible of numerous and easy communications with important places opening to the business and blessings of civilization, on both sides, there cannot be any danger of ultimate reimbursement. The whole territory benefited by such an undertaking, is in effect mortgaged for securing reimbursement, every passenger on the road, and every article of export which it accommodates, will contribute to this end.

There will be assuredly a great increase in the value of lands adjacent

to it whether owned by individuals, companies, or the Government, because the timber which nature has spread over them and every article of produce which the hand of industry may reap from them, will be increased in value *produced by the improvement*, must necessarily, and will cheerfully, be shared between the owners of it and the road maker.

A highly respectable public functionary, whose mind is deeply impressed with the importance of your road, and whose sympathies embrace all the great interests of the province, suggests the expediency of a local tax, as the best means of fiscal supplies, for the cost of the work; and offers his individual aid with the most praiseworthy liberality.

This seems at first view, a most natural and reasonable resort. In considering all the effects and benefits of the work, and their chief local applications, a fair mind would easily be led to making such suggestion. But what would be just, is not always expedient and some times it is impracticable. An attempt to obtain the necessary funds from a local tax, we think would prove both. In considering the details of this taxation we find the grounds of our opinion. Few people pay taxes voluntarily. They require an exact description of the property taxed, and a legal warrant to collect the tax. A local tax on a territory extending 12 miles in width, on both sides of a line subject to frequent curves and traversing a new district of 143 miles, would require accurate and extensive surveys, to ascertain the external limits of its application.—Then come the perplexing and tedious toils of determining the lines of distinct ownership within the prescribed limits: then the apportionment of the tax according to conjectural future benefits: then the Collector with his warrant enters upon a duty requiring much time and labor, and which must be but in part successful. Then inaccuracies of description, the impossibility of finding some agents of companies and some individual owners, the perversity of many and the inability of more, would be found to require a renewal of most of the preceding labors. In these details many persons must be employed, designated and empowered to act with legal effect; some of whom would be unfaithful, and some unqualified: and after the most unprofitable delay and best services that could be obtained, but little money would have been produced: and even that little would be frittered away, by all the drawbacks of numerous commissions and complicated agencies. Such results by such means would be most discouraging, and the plan of its attainment would at last be abandoned. But such a process or something very like it, would necessarily be adopted to enforce the collection of a local tax.

The idea of exacting a precise sum from every 200 acres of land included in each lateral strip of a mile wide within 12 miles of the Road on each side, without reference to particulars of quality, accessibility and vicinity to the most important points, would seem to be inequitable if it could by any means be obtained; and in unsettled districts owned in different proportions by individuals, companies, and the government, we think could not without much difficulty if at all be realized, voluntary subscriptions for stock by interested individuals, and by capitalists having confidence in the undertaking, and above all, by *Government*, seems to be the natural and only adequate resort.

Abridged Tabular Estimate for a Rail Road from Burlington Bay in the Gore District to Chatham in the Western District.

Division 1st, 10 miles 6 chains.

From Burlington Bay to the summit between the valley of the Lake and Grand River.

		Miles.						
Sec. 1	1½	{	Cutting	51090 yards,	6d.	£1277	5	0
			Embankment	1000 "	"	25	0	0
2	3½	{	Cutting	33000 "	"	825	0	0
			Embankment	21100 "	"	527	10	0
3	5 6-80	{	Cutting	287000 "	7½	8968	15	0
			Embankment	150700 "	5	3139	11	8
			Rock Cutting	53000 "	3	7950	0	0
			2 Culverts,	-	-	400	0	0
			16 Box do.	-	-	200	0	0
10 6-80ths						£23313	1	8

Division 2d, 13½ miles.

From the summit to Brantford at Grand River.

		Miles.						
Sec. 1	8½	{	Embankment	180970 yards,	6d	£4524	5	5
			Cutting	153000 "	7	4462	10	0
2	5	{	Ditto	90300 "	5	1881	5	0
			Ditto	190400 "	6	4760	0	0
			1 Culvert at Fairchilds Creek,	-	-	450	0	0
			4 do.	-	-	1000	0	0
			20 Box do.	-	-	350	0	0
13½						£17428	0	0

Division No. 3d, 21 miles 35 chains.

From Brantford to summit between the Grand and Thames Rivers.

		Miles.						
Sec. 1	4	{	Cutting	112,500 yards,	6d.	£2812	10	0
			Embankment	130,600 "	7½	4081	5	0
2	17 35 80ths	{	Cutting	160,340 "	5	3340	8	4
			Embankment	203,110 "	6	5077	15	0

Viaduct across Grand River, - -	3750	15	0
2 Culverts - - - - -	750	0	0
28 Box do. - - - - -	490	0	0

21 35-80ths £30,301 18 4

Division No. 4th, 32 miles 50 chains.

From summit to London.

Sec. 1	13	50-80ths	Cutting	69,300	yards,	7d-	2021	5	0
			Embankment	137,400	"	7	4293	7	6
2	19	{	Cutting	184,800	"	6	4620	0	0
			Embankment	275,200	"	7½	8600	0	0
			1 Viaduct at River Thames, - -			-	2000	0	0
			1 do. middle branch of do. - -			-	1000	0	0
			Bridge at Cedar Creek - - -			-	500	0	0
			4 Culverts - - - - -			-	1800	0	0
			46 Box Culverts £20 each, - -			-	920	0	8

32 50-80ths £25754 12 6

Division No. 5th, 64 miles 42 chains.

From London to Chatham 64 miles 42-80ths.

Miles.

Sec. 1	10	{	Cutting	135,400	yards,	7½d.	£4231	5	0
			Embankment	145,700	"	8	4890	0	0
2	54	{	42-80ths Cutting	310,000	"	6	7750	0	0
			Embankment	485,400	"	"	12135	0	0
			Viaduct over Thames at London,				2500	0	0
			Bridge at Dingsman's Creek, - -			-	500	0	0
			4 Culverts, - - - - -			-	700	0	0
			60 Box Culverts, - - - - -			-	1200	0	0

64 42-80ths £33906 5 0

ABSTRACT.

Division No.	1	10	miles.	6	chains.	23,313	1	8
"	2	13	"	40	"	17,428	0	0
"	3	21	"	35	"	20,301	18	4
"	4	32	"	50	"	25,754	12	6
"	5	64	"	42	"	33,906	5	0

142 miles. 13 chains. £120,703 17 6

Grubbing, Slashing, Clearing, and Timber }
work £250 per mile, } 35,540 2 6

142 miles	13	chains	Iron & splicing plates	£450,	63,963	2	6
"	"		Spikes,	£50	7,108	2	6
"	"		Sawed Scantling,	25	3,554	1	3
"	"		Laying Iron and Scantling,	25	3,554	1	3

Total. £234,423 7 6

Remarks.—Least Radius of Curvature 10,000 feet Greatest length of continuous straight line 54½ miles. Reference is had to a general

map showing localities, and to particular maps and profiles of line surveyed accompanying this Report.

Important scientific results and their explanation would accompany the minute details of a final location.

Reconnoissance of Division No. 6 and 7, and comparatively estimated as follows:—

No. 6	£1 250	per mile,	50 miles	£62,500
" 7	1 500	" "	47 "	70,500

The expense of constructing the timber work, according to the plan herein recommended, is difficult at present to give you in all its detail. From the peculiar form of construction, the economy of doing the work by the day, and the varied character of the work in different situations. Perhaps it may be best ascertained by the following divisions into particulars. A great proportion of the way, the grade line of your road may conform very nearly to the natural surface of the ground; in which case it will be raised two feet above the surface; and require the standing trees to be cut, nearly even with the surface, to the width of the road bed about 14 feet; the large trees standing in the side ditches must be grubbed; and those outside of the ditches cut down with the usual height of stumps—occupying in the road bed, the ditches, and the chopping on both sides, a width of 100 feet. A mile of road will require 1036 blocks two feet in length, and from 18 to 24 inches in diameter, and 10,560 feet of string pieces, running measure, 18 to 24 inches in diameter, and in pieces 20 or 30 feet long each. All timber in the line not wanted for the above specifications must be placed outside of the ditches. To complete the timber work, on a mile of road of this description, within one month, allowing 24 working days, will require the services of the following persons, who will live together in a shanty on the line, and find all their provisions, cattle, forage and implements, to wit:

One superintendant to be allowed full time	26 days, 7s. 6d.	£9 15 0
One Principal Hewer,	24 " 7s. 6d.	9 0 0
One Assistant, do.	24 " 6s. 3d.	7 10 0
One Adzeman,	25 " 6s. 3d.	7 10 0
One Team, with 2 yoke of Oxen	24 " 12s. 6d.	15 0 0
Fifteen, Axe & Saw Men,	24 " 5s.	80 0 0
Total expense		£139 15 0

Such is the amount of labor, and cost of preparing the timber work to receive the sawed scantling, and the iron, involving an expense for mechanical labour of only £24

A mile of such road would contain 12 eighty one hundredths of an acre, which to clear and fence, and prepare for a crop, at £5 per acre, would cost the farmer £61 0 0 nearly half the amount required to clear away and prepare the timber in the form proposed.

To prepare the grading of this mile, the broad bed being 14 feet wide, and the earth having a slope one and a half foot base to a foot rise, and covering the timber to its upper surface, requires the excavation of ditches $2\frac{1}{2}$ feet deep, $2\frac{1}{2}$ feet wide at bottom and 10 feet wide at top with a slope as above, and containing 6104 cubic yards of earth which at 6d. per yard amount to . . . £152 12 0
And to this the cost of timber work as above . . . 138 15 0

And the aggregate is . . . £291 7 0

Where the grade line adopted requires 3, 4 or 5 feet cutting and embankment the expense of grading would be greater, though in such cases the ditches would only be required in the cutting, and be of less dimensions, to answer the purpose of drainage. (I have witnessed the execution of such a work costing £95 per mile.)

I have completed the foregoing estimate, for a single track of Rail Road, on the preliminary survey being the only one that could be made from actual survey, upon plans having constant reference to economy. It embraces a great length of straight lines, with favorable grades and the removing of prominent barriers by expensive structures and deep cuttings, and yet I trust will be thought within the ability of those who desire the accomplishment of the work. Contingencies, expense of the Engineer department, and Commissioner not included. Also the sidelings, Depots, Locomotives, cars &c. constituting the machinery of the Road. Also the cost of right of way and other lands that might be anticipated for so prominent and extensive a work. I would here observe that all of the above contingencies, would occur in short lines of Road: Therefore the more extensive and important the rout is, a less proportional expense is born by the company. This Road is of that length to be within the reasonable control and management of one set of officers, agents and servants, and perhaps as favourable a length of line as could be undertaken in that respect.

You are entitled to an apology for the delay which has arisen, in completing my report; and for the trouble which you have been subjected to, of sending a messenger to urge forward its preparation. I

hope you will find a satisfactory one in the subjoined facts. 25 miles of the Tonawanda Rail Road have been recently brought into operation, under my charge. The necessity of introducing a heavy class of locomotives to move the crowd of freight passing upon it, the multiplicity of fixtures and details connected with the construction of cars for the first use even of a sheet work, and the anxieties of the company with whose funds the work has been so far completed, presented such claims upon my attention as could not be passed by or postponed. The stock of this company is held by a few active and intelligent gentlemen, in Rochester and Batavia. They have expended £75,000 in applying plans of my projection and recommendation, and for their honorable confidence in my views I could not but feel a strong obligation. The practical test of the utility of the plans, and the justification of their confidence, was to be experimentally ascertained. It was therefore a period of great concern to them and me.

The test was to consist in running heavy locomotives, with great speed, and full freighted trains, upon the road while it was yet new, and nothing would contribute to its solidity, but the simple materials of which it was composed, and the manner of their combination. The Road withstood the test with entire success. It was applied at the commencement of the sittings of your Parliament. Since then, individuals and committees from other Rail Road Companies, have come to examine and approve the plans. They are the plans recommended in this Report, and you can now adopt them under all the advantages derived from actual experience of their sufficiency. »

There is a consideration of great weight making it peculiarly expedient to press forward the internal improvement of the Province, without delay. It refers to the number of Emigrants annually arriving in your territory, and their necessities, capacities, and future condition.

The population of the eastern continent is overflowing in a measure altogether unprecedented; and the best portion of the labouring emigrants are swarming to North America. These people will be productive, useful and valuable in proportion as they find the means of an honest livelihood by their industry. Most of them have been accustomed to labor on roads and canals, and other public works. Whenever they arrive they must live. Many of them having families and others feel the obligations of duty, and are ambitious of providing a competence for themselves and their children. Well employed, they become respectable. Without employment distress soon makes them dangerous; for

necessity knows no law. Thousands of these emigrants would rejoice to be employed on your roads and other public works, for a frugal subsistence: and with suitable subjection to men knowing the climate and country, and the best methods and terms of applying labor here, these would afford you the most essential aid at the least possible expense.

Labour is the primitive and only human source of wealth. Employ the Emigrant, attach him to your territory. By devoting all their energies to the making of your roads and canals, they will be contented, peaceable and comfortable; and they will serve all your interests not less than their own. It is true, these transatlantic laborers often arrive enfeebled by sickness, and discouraged by the new scenes of exposure and privation attending their voyage. But these are temporary evils, and soon disappear.

The internal improvement of the States bordering on you, are advancing rapidly by the strength of these strangers, and in past years have actually called away from your reach, much of the most appropriate material to nourish your individual opulence.

It is the office of foreseeing prudence to regard every expensive project in all its connexions, for upon these, much of the interest of all things ultimately depends. The position of the London and Gore Rail Road in our judgment makes it susceptible of more advantageous local connexions or branches, than any other projected, or possible in the province. And its preeminence, in reference to more remote and general lines of communication, are still more obvious and impressive. Of local connexions, in addition to its intersection with Grand River, at a point rendered navigable, it may easily have branches from Woodstock to Goderich, from London to the Ausable, from Chatham to Bear Creek and out let of Lake Huron, from Bertie to Brantford, this forms an important connexion with Niagara River and Buffalo, and from other points to important ports on Lake Erie, and at a period accelerated in proportion to the progress of a just domestic policy. From Hamilton over Burlington Heights to the seat of Government, also to towns and cities requiring names and boundaries, upon your maps and charts. Thus besides the happy circumstances of its terminating points, offering so many and such easy avenues, to whatever is most valuable in the rich interior, as cannot fail to bring out all its resources, in the boldest relief, and unite all its inhabitants by the most desirable reciprocations, of business and affection.

Look now at its most remote connexions. Through the Northern part

of New England and the northern part of New-York, enterprize with sufficient means is opening a great road to the St. Lawrence. From Boston a Rail Road is now in great forwardness to Albany. From Albany a similar improvement is more than half completed to Oswego. A company is chartered in New-York and their work is now in progress to break through the only obstacle to a continued navigation between the Chesapeake Bay on the Atlantic and Sodus Bay on Lake Ontario. 180 miles West, is the port of Rochester, a city favourably known to you in commercial intercourse. This city is intersected by the Erie Canal,—the Olean Canal forming a connection with the valley of the Ohio, and several important Rail Roads now constructed and being built.

The City of New-York has an easy navigation to both the great lakes, on your South, and all the Northern and Middle States are every where adjoining their surface, and darkening their maps, with new projects of Rail Roads and Canals, executed or executing.

You are aware that the borders of your Province, and the East and West roads lying south of it, are now continually thronged by a stream of settlers from the East. Such multitudes crowd this stream that the waters are wearied by their passage and all ordinary roads broken up by their continual footsteps.

These settlers are increased by large bands from portions of your sister Province, and they will be much more numerous by every new facility of passage. They are all struggling in the mighty work of carrying industry, art, science, and religion through the barbarous and almost interminable wilderness of the West. They will persist in the full accomplishment of their holy mission. Nothing can divert them from it. Born and bred for the most part between the 41st and 46th degree of North latitude, what track in their Western migration will those people most naturally follow; Equally familiar with intercourse by water and by land, and knowing all the facilities of each, will you neglect to open to these people the best highway in your power? Your Peninsula lies directly across their route, stretching through all the degrees of latitude from which they spring. It is now an impediment to the facilities of their march, and crowds them far to the South. But look to the progress of population in Michigan, and the immense territory West of it, and you will discover numerous settlements, in your latitude, each filling up, by an annual addition of thousands. Nothing but physical impossibilities or an absolute destitution of means or another cause too disreputable to be mentioned, could account for any farther hesitations or delay. Provide the London

and Gore Rail Road, and within one year after it is completed more passengers will crowd upon it, than the company, at least, will be prepared to transport.

Does this seem extravagant? It will not be found so, if natural tendencies are not controlled by needless and pernicious regulations. The new planters of the west do not in leaving their native hills forget their early associations. The intercourse of friendship, the claims of inheritance, the advantages of education, and above all the enterprizes of trade impel them often to retrace the paths of their departure; but the east, and the north-east and the great west are not; the only quarters from which distant passengers will arrive at your road. There is a great circle of travellers revolving continually through the valley of the Mississippi and that of the Ohio, the lakes Erie and Ontario, the waters of the St. Lawrence or the Erie Canal and the principal cities of the Atlantic. This circle embracing many from the West Indies and Europe and is every year enlarging the list of persons coming into it. It is composed of the fashionable, the opulent and the curious. The great waterfall in your border is in its periphery and a principal point of attraction, insomuch that it detains for days and weeks large numbers of those who move in it.—The road in question would be in reach of all such, and would not fail to enjoy the profits of their passage through it. The exhilaration of a safe and easy journey, by the light of a single day, through a rich interior from Queenston and the Falls or from Toronto, to Detroit, would be necessary to the fashionable and various objects on the rout would interest the curious. Every road by land or water across the Peninsula of Michigan, and every communication from the Ohio to the north, as well all the facilities of travel in New York and the East would serve to increase the labor of your locomotives: and as certain as the vicissitudes of day and night shall continue, a Rail Road with a double track substantially constructed from Hamilton to Chatham, and supplied with the best machinery would soon be unable to convey more than the passengers and light articles resorting to it. In ten years the Erie canal of New York has paid principal and interest of all its cost. In a shorter period, your much less expensive improvement, would reimburse the necessary outlay of its construction. Do not toy with the lion when you can make him put forth his greatest energies in your service,

It is of the utmost importance that you should waste none of your means, by undertaking too many projects at once, or by biasing interference of interests. To an eye raised above all the mists of self interest, and discerning in a just light the aggregate wants of the Province,

nothing can be more obvious than the policy of combining—not perhaps all your efforts—but your chief and by all means sufficient efforts *in the first place*, in opening the most direct, practicable and central Rail Road, from Lake Ontario across the Peninsula to the great water way of the west. Do this, and within three years you may be conducted by the magic power of steam and enjoy a passage of six hours from Burlington Bay to steam boat navigation on the Thames, and the results will soon enable you to fill your whole Province with valuable lines of improvement.

The road should be so laid as to leave no wish to the future, to change its location, direction, curvature or the economy of its grades. In opening it, there would be great economy in constructing a double track, with cross timbers connecting the whole, while there is an abundance of timber encumbering the line. If a delay was necessary in the supply of iron on any portion of the work the timber might remain with an extra covering and be preserved unimpaired and used where necessary for sidelings. We should prefer substituting the iron T. rail which would answer admirably on the broad flat surface of the string pieces, and may be less than half the weight of the new Manchester and Liverpool parallel rail or the Boston and Providence T. rail which are designed for bearings each three feet.

This alteration of the plan proposed would leave all of the timber work buried in the grade and thereby give it increased durability. The culverts and viaducts on the whole line should be from the Ancaster quarries,* prepared and transported upon the line of Rail Road. The Depot and its portals should be erected on a scale that the great object and and crowd of passengers demand. The Locomotive Engines to be of a heavy construction of great power, and manufactured at the most approved work shops of the mother country. Local work-shops should be established with ample supplies of foreign and domestic materials for the necessary cars and machinery for the road. The designs and plans of the work should be comprehended in its commencement—the character of the work such as to demand the confidence of the Stockholders and secure a profitable public market for its capital.

It should be a Provincial work so far as the character of the enter-

Here are valuable varieties of the lime formations cropping out 500 feet above the Lake and south of the principal Terrace. These are of great value for the construction of public works, and the country west. They are not noticed I believe by any Geological Survey of the Province.

prize is concerned. The main artery and the several branches will lead to the capital of the Province the means of great commercial wealth.—While the Albany and Troy, Utica, Rochester, and Buffalo, of the proposed great thoroughfare will rise from their limited prosperity and materially add to your Provincial greatness.

In the progress of this Report, we persuade ourselves, that many facts are set forth, and many principles advanced, which serve better than any mere theories or speculations, to invite and justify confidence, in your patriotic enterprise.

In our desire to illustrate and enforce these facts and principles, we have some fear, that we may be thought to have trespassed upon that respect, which is justly due to the high authorities of the Province, and the distinguished individuals engaged in various laudable schemes, for its internal prosperity. If in any degree we have seemed to commit this error, we feel that it would be unjust to suppose it intentional, and we hope to take shelter under the injunction of the worthy company in whose service we labour, to probe the subject submitted to us, in all its bearings and to state our facts and convictions, with perfect ingenuousness.

The Creator of the world has stretched out between the Canadas and the United States the most magnificent series of internal waters, that any where adorn his footstool. From these waters He has, for ages, sent forth His dews, and His rains to clothe the vast interior with lavish fertility, and in the course of His good providence, He has recently spread along both their shores, free governments, and a population eminently capable of understanding and educing the means of individual and national advancement. You are an important part of this population; and you occupy a most important position. Can you doubt or hesitate as to the task assigned you? Were the richest bounties of the physical world designed to go forever unimproved and unenjoyed by him, to whom dominion is given “over all the world?” The spirit of Internal Improvement, with a gigantic arm, has been long engaged below you, and beside you, in turning the lands and waters of wide regions into effective ministers of human good. You have seen the consequences; you have witnessed a more sudden accumulation of all that makes nations rich, populous, and powerful, than were ever, at other times and places, offered to the contemplation of man. You are evidently delighted with the spectacle and you feel the general impulses it imparts. Then cherish the spirit which exhibits it. He is knocking at your doors for permission to enter and pervade every department of your Province. Give him welcome admission. Assist his beneficent purposes. Let no imaginary fears

no local views, no narrow competitions come in between you, and the most vigorous prosecution of your truest interests and your highest honor.

All of which is most respectfully submitted,

ELI HA JOHNSON,

Chief Engineer.

*Engineer's Office, London and Gore Rail }
Road Company December 4th. 1836. }*

- Erratum.**—Page 20. 17th line, after Surface, add the *cross timbers*.
“ 21. 12th “ “ large, *string pieces*.
“ 26. 23d instead of 3d. read *three shillings*.
“ 29. the remainder of the 17th and 18th lines after the word *drainage*, should come in after the word proposed in the fourth line from the top.
“ 32. 7th line after Ontario, read 40.
“ “ 14th “ for adjoining read *adorning*.
“ 34. 16th “ after T. rail add, in place of the *cheaper and less durable scantling and plate iron, &c.*